DIFFERENTIAL DIAGNOSIS OF YAWS

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DEDICATION

To the late Dr J Fraisse and the late Dr M Gauthier, who lost their lives in the service of the World Health Organization, in appreciation of their contribution to the eradication of yaws

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INTRODUCTION

As progress is made in yaws eradication in many countries, it becomes increasingly important to acquire more information on a number of aspects of the disease in order to ensure the effective and economical conduct of the final stages of eradication campaigns. One such aspect is the differential diagnosis of certain skin and other lesions not caused by yaws from yaws lesions which they may resemble.

At all stages of a mass campaign for the eradication of yaws the clinical diagnosis should be as accurate as circumstances permit. It is realized, however, that in view of the limited amount of time available at initial treatment surveys and of the simple training of the field staff a certain number of errors in diagnosis are to be expected; under favourable conditions these probably amount to about 10% of all diagnoses of yaws. In the later stages of an eradication campaign, i.e., after the initial treatment survey and resurveys, the manifestations of yaws have largely disappeared as a result of mass treatment with penicillin. It is then that many lesions not due to yaws and not influenced by the treatment given become prominent, and the accuracy of diagnosis becomes more important both for assessing the achievement of the campaign and for planning further activities. Diagnostic errors may also be frequent when yaws is in spontaneous regression.

This monograph has been prepared in response to requests for an illustrated work which would assist field workers in making a differential diagnosis, and it is intended as a companion volume to the monograph entitled *An international nomenclature of yaws lesions* (Hackett, 1957). Only illustrations of lesions likely to cause confusion with yaws have been selected, no attempt being made to provide exhaustive illustrations of all the conditions referred to. Among the skin conditions which may be confused with yaws those causing lesions of the palms and soles seem to be the least well understood and the most troublesome; they have therefore been dealt with in the most detail.

It should be noted that in the descriptions which follow references to illustrations in the monograph, *An international nomenclature of yaws lesions*, are given using the abbreviation "*Yaws nomenclature*" followed by the number of the figure (e.g., *Yaws nomenclature*, Fig. 9).

Differentiation of the treponematoses

The differentiation, as given in textbooks, of the lesions of yaws from those of endemic and venereal syphilis has at present no great practical application in mass campaigns. Much confusion between these arises from inadequate knowledge and unsound criteria. A point that might give some slight assistance would be residence, especially in childhood, in an area where one of these treponematoses was preponderant or present to the exclusion of the others. Some workers think that a history of having had yaws has some diagnostic value, but this is largely dependent upon personal experience and upon the population concerned. It is possible [illegible] sounder criteria will be needed than are available at present.

Treponemal and other skin lesions

The skin has a limited number of reaction patterns, so that similar lesions may result from different causes. This concept, so clearly expounded by [illegible] *of an eruption, its method* of [illegible] symptoms, in addition to [illegible] Only a few lesions are truly diagnostic of yaws and often the repetition of the same pattern in an endemic area tends to be taken as evidence of yaws.

Two diagnostic aids are frequently employed; the first is the serological tests used in all treponematoses, and is of little value in the individual case in an area where either yaws or syphilis is endemic and where sera from more than half the population may be reactive. The second is the response to antitreponemal therapy, chiefly in the form of penicillin. This may be of some practical value but is of little scientific value because penicillin is effective in all treponemal and in certain non-treponemal diseases.

The possibility of more than one disease being present in the same patient should be kept in mind.

LESIONS LIKELY TO BE CONFUSED WITH EARLY YAWS LESIONS

Impetigo contagiosa is a pyogenic infection characterized by discrete thin-walled vesicles and bullae which become pustular; the exudate on drying forms darkish yellow crusts (Fig 1). When these crusts are removed the lesions seem to be eroded but not elevated. Healing occurs without leaving scars. The face is the most frequent site. The onset and course of impetigo are more rapid than those of yaws papillomata. Yaws papil-omata (*Yaws nomenclature*, Fig. 11 B) are larger discrete lesions, more aised above the skin, and are often present on other sites than the face. he surface of the hypertrophic yaws papilloma is more coarsely granular an that of impetigo In impetigo some flaccid vesicles are usually present -out the edge of the lesion. The infection readily extends to any skin abrasion.

Ecthyma may complicate impetigo or appear *de novo* at the site of abrasions or insect bites It extends into the corium (Fig. 2) and consequently leaves scars (Fig. 3) There is a resemblance between ecthyma and the early yaws papilloma (*Yaws nomenclature*, Fig 11 A), but on removal of the crusts the former shows ulceration (i.e , loss of dermis) instead of raised vegetations. Furthermore, purulent exudate is often present in ecthyma and is absent in yaws papillomata, this is an important diagnostic point.

Scabies is characterized by tortuous burrows in the horny layer of the epidermis made by the female mite, and into which she lays her eggs, and by small papular and pustular lesions which may outnumber the burrows. Intense itching, especially at night, leads to a wide range of appearances due to scratching, secondary infection and pustules (Fig 4) Diagnosis may be confirmed by finding the *Sarcoptes scabiei* or its products in the burrows. Except in rare cases in infancy, scabies does not affect the face and scalp The most commonly affected sites are skin folds such as between the digits, the wrists and forearms, the points of the elbows, the anterior axillary folds, the genitals and the buttocks (Fig. 5), and nipples The skin below the internal malleoli is often involved in children The papillomata of yaws are usually larger and more granular than the late confluent lesions of scabies and have a different distribution.

Tungiasis, caused by *Tunga penetrans* (synonyms jigger and chigoe), since it may occur in children as well as adults, is likely to be confused with plantar papillomata, especially since in both conditions the lesions are moist and tend to be circular (Fig 6 , cf *Yaws nomenclature*, Fig 13 B)

It is prevalent in South America, the Caribbean Islands, Africa, and the west coast of India and does not occur in Asia, South East Asia or the Pacific. *T. penetrans* in Africans is nearly always multiple. If many contiguous parasites are present the lesion may resemble a dryish papilloma. The uniformity of the size of the individual lesions, whether active or healing, is of help (Fig. 7) Diagnosis will be confirmed by removal of the parasite or by observation of the posterior extremity of the parasite extruding small pellets of reddish brown faeces or batches of eggs amid the debris. *T. penetrans* tends to occur most frequently on parts of the sole not in direct contact with the ground and thus between the toes and on the borders of the feet. Since the *Tunga* occupies the dermis it causes pain, and secondary infection is usual. The female parasite remains in the sole until she has laid her eggs and then is shed. The impregnated female is 3-5 mm in diameter and produces a cavity in which she lies. On healing, only slight scarring remains. The *Tunga* lesion starts as a small irritable point, while the plantar papilloma starts as a deeper, very painful swelling which ruptures through the normally thick cuticle. In plantar or palmar papillomata the moist base is either discoid or, if there is a central dry raised area, annular.

Leprosy, especially its macular lesions (Fig. 8), may be confused with macular (*Yaws nomenclature*, Fig. 3 A) or maculo-papular yaws (Davey, 1957) The presence of other manifestations of either disease would resolve some uncertainty. In lepromatous lesions *Mycobacterium leprae* can usually be readily demonstrated. In tuberculoid leprosy involvement of nerves should be sought by testing for loss of sensation to heat and cold and to light touch and for absence of sweating. More difficulties may arise with the flattish " macules " (Fig. 9) of early indeterminate leprosy, in which nerve damage may be difficult to detect and the range of the lesions may be wide. (cf. *Yaws nomenclature*, Fig. 9, 11 F, 11 G.)

Tropical ulcer (see also page 21) may resemble the ulcero-papillomatous initial yaw (*Yaws nomenclature*, Fig. 2). Among other conditions which may be difficult to distinguish from the initial yaw on clinical grounds are various forms of chronic *vegetating pyoderma* and *cutaneous leishmaniasis*. The last condition, one of whose numerous synonyms, " forest yaws ", may cause confusion, can appear as single or multiple nodular or ulcerative lesions on the exposed parts. Clinical differentiation may be difficult and a search for leishmania or treponemes in deep scrapings may be necessary.

Chronic furfuraceous impetigo (synonyms : *impetigo pityroides*, *pytiriasis alba*, erythema streptogenes, pityriasis simplex faciei, dartre volante) is very frequent and ubiquitous and may give rise to diagnostic difficulties with squamous macular early yaws. It is practically confined to children. The earliest lesions often consist of grouped, minute, hyperkeratotic papules resembling lichen spinulosus.

Lichen spinulosus is probably best regarded as a common reaction type, for although it may occur as a distinct entity, it may also occur as an unusual manifestation of other diseases, such as lichen planus. Acuminate micropapular early yaws (Smith, 1932, Fig. 23-25; and *Yaws nomenclature*, Fig. 7 and 8), is clinically indistinguishable from lichen spinulosus.

Thus two manifestations attributed to early yaws are duplicated by an extremely common and geographically ubiquitous skin disease of children. Chronic furfuraceous impetigo is a superficial inflammation of the skin. The macular lesions, which are usually discoid, are sharp-edged and average 3 cm in diameter. Their surface is only slightly scaly. In the earlier stages the lesions are faintly erythematous, but they are usually noticed only when the erythema has disappeared and hypopigmentation (not complete depigmentation) is apparent. Brand & Tass (1952) found it present in about a half of the schoolchildren they examined in Israel and quote Wise as saying that it could be found on the skin of all North American Negro children if they were carefully examined This applies to a great extent to white and Bantu children in South Africa, where all stages from lichen spinulosus to furfuraceous impetigo are frequent and where yaws does not occur.

Pityriasis rosea is another dermatosis of world-wide distribution. It produces round or oval, scaly plaques (Fig. 10), with a tendency to form "collarettes", or peripheral fringes (Fig 11) The greatest diameter of the plaques is in the direction of the cleavage lines of the skin The disease is confined to the trunk and proximal parts of the limbs and usually lasts six weeks or less.

Psoriasis, though relatively infrequent in the coloured races, may, however, cause confusion, especially when the palms and soles are affected. The distinctive type of desquamation (Fig 12) in psoriasis, with dry, silvery scales, its well-known distribution on the extensor surfaces of the limbs, especially the knees and elbows, and above all its chronicity, help to distinguish it from the lesions of annular, circinate or serpiginous papillomata (*Yaws nomenclature*, Fig 11 F and 11 G) When the scales are removed from a lesion, the glistening smooth surface with bleeding points is characteristic, as is pitting of the nails when present.

Mycoses of the hands (Fig 13), feet (Fig 14), and body may cause confusion and require microscopic examination of scales for the presence of fungal hyphae. They may occasionally be confused with circinate papillomata or hyperkeratoses. However, the thickening of the skin in the mycoses is rarely as great as in the yaws lesions. In the papillomata there is less desquamation and less surrounding inflammation of the skin (*Yaws nomenclature*, Fig. 15 G and 15 D) In mycoses of the palms islets of healthy skin may be isolated in the lesion and pompholyx lesions may

occur, especially along the fingers. These palmar and plantar mycoses do not respond to anti-yaws treatment and are probably some of the " yaws hyperkeratoses that do not respond to penicillin ".

Phrynoderma on the extensor surfaces of the limbs (Fig. 15) closely resembles umbilicate papular early yaws (*Yaws nomenclature*, Fig. 6), and other signs of vitamin A deficiency, such as night blindness and Bitôt's spots, should be sought.

Recalcitrant, symmetrical palmar and plantar pustular eruptions, sometimes called **pustular bacterids** or pustular psoriasis, and probably related to acrodermatitis continua, may resemble yaws hyperkeratosis, but they are rare.

Drug eruptions are rare in communities where yaws is endemic, but the papillomatous and fungating lesions of bromoderma and iododerma may occasionally closely resemble the papillomata of early yaws.

Sickle-cell anaemia in infants (Lambotte-Legrand & Lambotte-Legrand, 1958) may cause characteristic swellings over one or more metacarpal or phalangeal bones (Fig. 16). These are warm, painful and tense, and resemble an infective osteomyelitis or dactylitis. These lesions are most frequent during the second six months of life and after one or two weeks disappear spontaneously. Faint periosteal shadows and occasionally areas of necrosis within the bone resembling those of osteomyelitis may be seen in radiographs. Suppuration is rare. Swelling in the long bones of the limbs may occur in older patients. Enlargement of the liver or spleen, jaundice, cranial bossing or other characteristic changes of sickle-cell anaemia may be present (Hendrickse, 1960). Dactylitis in yaws (*Yaws nomenclature*, Fig. 18 E) is exceptional during the first year of life, and then papillomata would probably also be present.

Tuberculous dactylitis may closely resemble the polydactylitis of early yaws (*Yaws nomenclature*, Fig. 18 E). In children, in the early stage of infection (Lambotte & Legrand, 1953), swelling of the fingers of short duration (Fig. 17) without radiographic changes may occur; these may be associated with other early tuberculous lesions, such as adenitis, kerato-conjunctivitis, rheumatic pains or erythema nodosum, either at the same time or later. Spina ventosa in which the phalanges and metacarpals are expanded and the cortex is rarefied is occasionally seen.

LESIONS LIKELY TO BE CONFUSED WITH YAWS HYPERKERATOSES

Palmar and Plantar Lesions of Uncertain Cause

Palmar and plantar lesions not due to yaws are likely to be confused with those due to yaws whether the prevalence of active yaws is high or low. The yaws lesions of the palms and soles present a fairly consistent pattern in all yaws endemic areas and such lesions do not occur where yaws is absent The first well-illustrated description is by Baermann (1911). The undoubted yaws lesions of the palms and soles include the plantar papillomata and the early and late hyperkeratoses, which have been illustrated again recently (Hackett, 1957)

Lesions of the palms and soles not due to yaws form a confusing group, of which a few are rare but ubiquitous. Some appear to be chiefly limited to the coloured races; it is probable that this racial prevalence is the result of environmental factors. The lesions may be classified conveniently as (1) those with pitting, with or without plugs, and (2) those with diffuse hyperkeratosis, with or without fissuring. Palmar and plantar lesions occur in many parts of the world, regardless of the presence of any endemic treponematosis. Most of these lesions do not resemble yaws lesions and are not affected by therapy to which yaws lesions rapidly respond. Turner (1959) also refers to these non-yaws lesions

Some of these lesions have been recognized for many years but their recognition has become of more practical importance in the later stages of the present effective yaws eradication campaigns. Mistakes most often arise from the erroneous belief that all palmar and plantar changes, in a population where yaws is frequent, are due to yaws. The recognition of this error is immediately followed by more accurate diagnosis.

Pitting

Without plugs

Larger pits, up to 5 mm in diameter. These start on an apparently normal sole, especially on the heel, as punctate excavations. They form shallow, round or oval depressions (Fig. 18) up to 5 mm in diameter, which do not extend below the stratum corneum, and the papillary ridges may remain visible across the bases (Fig. 19). The pits occur on points of pressure on the foot but the pressure points of the toes are spared in the early stages Usually all or most of the depressions are of about the same size. They may coalesce to form linear depressions or furrows (Fig. 20), and may be contiguous over a large area but remain discrete with each depression separated by narrow ridges. The depressions may

occur, especially along the fingers. These palmar and plantar mycoses do not respond to anti-yaws treatment and are probably some of the "yaws hyperkeratoses that do not respond to penicillin".

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be less than 1 mm and up to 2-3 mm below the surface (Fig. 21). When the changes are extensive some resemblance to crêpe rubber may be noted on casual inspection (Fig. 22). These depressions may become filled with soil or debris, which is easily removed with water, when the bases of the pits are clearly seen. In the early stages there is little or no thickening of the skin but with more marked changes there may be some thickening; however, the skin remains comparatively soft and pliable. Inflammation and abnormal desquamation are absent. When the changes are marked, the skin has a yellowish colour. These lesions do not affect the palms. Pain is not marked, but may follow much walking. The changes start in later childhood, when the prevalence may be much higher than in adults; this suggests that spontaneous healing is frequent as do reports that the lesions are more prevalent during the rainy season and that they resolve during the dry season. Furnell (1943) observed these lesions develop after one week's unaccustomed exposure to wet conditions, and other observers report that resolution has followed removal from wet working conditions to dry ones and the adoption of footwear at the same time. Rest and local application of salicylic acid are reported to produce marked improvement.

In patients with this condition serological tests for syphilis are not reactive in the absence of treponemal infection. There is no response to treatment with arsenical or penicillin preparations. The condition occurs in Ceylon, India, Taiwan, Africa and Indonesia, but its distribution and prevalence are not uniform. The lesions are practically confined to the wet tropics and are rare or absent in arid areas. Until the condition is better defined, it and its variations as seen in Fig. 18-22 should be called "tropical plantar pitting"; it may comprise more than one pathological entity. The term "keratoma plantare sulcatum" (Castellani, *1910*) is misleading, but refers to the same condition; this problem is discussed more fully in the Annex (see page 77).

A somewhat similar infrequent cribriform lesion, so far described only in white patients, is seen in the late stages of "Pernet's symmetrical lividity of the soles". The weight-bearing areas of the sole are most affected. The horny layer becomes soft and offensive through maceration. Hyperhydrosis is always present, and is possibly the most important cause.

Smaller pits, 1 mm in diameter. There is another type of plantar pitting of which no published description could be found, in which the skin is slightly thickened and dry and in it are numerous pin-point perforations (less than 1 mm), from which may extend some short, fine fissures. These have been seen in arid, but not in humid localities. They have been observed only in the soles. For the present, this lesion might be referred to as "punctate plantar pitting" (Fig. 23). The cause is unknown and the condition is not limited to the tropics.

Although somewhat similar lesions have occasionally been seen in the centre of macular or plantar hyperkeratosis of early yaws, punctate plantar pitting is not treponemal. Tiny pits are also seen in apparently normal skin adjacent to plantar warts (see page 20).

With plugs

There is a rare hereditary disorder which is characterized by small horny plugs in localized thickenings of the epidermis. Palms (Fig. 24) *are most frequently involved but the soles may occasionally be affected.* The plugs eventually separate, leaving pits, each of which is surrounded by a narrow horny rim This condition appears to have been originally described by Brauer (1912) and has been named " keratoma dissipatum hereditarium palmare et plantare " (Kiess, 1930). The keratodermia of Buschke-Fischer, which is not hereditary, and that of Besnier and the keratodermia punctata of Chalmers & Kamar (1917) (see Annex) are probably identical with the keratoma of Brauer Pits, a few millimetres in diameter, resulting from the separation of horny plugs together with fine desquamation in the skin creases on the palms and soles have been reported in lichen ruber planus (Kiess, 1930, his Fig. 6) but is rare.

The palmar lesions illustrated in Fig 27 A of Yaws nomenclature are probably due to Brauer's keratoma, while the changes on the fingers are due to yaws.

Plantar thickening and fissuring

Thickened and fissured soles have been seen in many parts of the world. Fissures about the heels occur in moist and in dry countries, thickening and fissuring of the soles is frequent probably in arid areas only These changes start in late adolescence and marked lesions are seen only in adults who do heavy work They are usually not very painful but deep vertical fissures of the heel may be

Several rare types of familial and sporadic hyperkeratosis of the palms and soles have been described in patients of different races but will not be referred to here

Congenital or acquired dryness of the skin (xeroderma) may be associated with hyperkeratosis of the palms and soles and with vertical fissures at the margins of the heel (Figs 35-37) These changes are seen in ichthyosis vulgaris. They also occur with greater severity in the dry season, both in ichthyotics and in those whose skins have become excessively dry as the result of advancing age. Xeroderma may occur in cachexia and in malnutrition, and plantar hyperkeratosis and fissuring of the heels have been attributed to pellagra It is possible, therefore, that the condition under discussion results from several factors, among which the most important may be xeroderma due to malnutrition. A dry climate and

injury from walking barefoot on hard ground may thus be contributi The lesions referred to here as "plantar thickening and fissuring" not treponemal in origin and may well, on further study, be founc comprise several pathological entities. The following clinical types i be recognized.

Plantar folding and fissuring along the skin creases in the anterior l *of the soles*. The folds and furrows tend to point away from where heads of the metatarsals press the skin of the sole upon the ground dui walking. When folds alone are present the skin does not appear m thickened and it has nearly normal elasticity. The folds are seen in Fig. from a young man with no active yaws. The fissures alone are seen Fig. 26, from a woman about 18 years of age who also had papilloma nine months later, after neoarsphenamine treatment, there were no act yaws lesions and the soles showed little change except a tendency for fissures to become folds. The serum was then non-reactive to the Ka test When fissuring alone is present the skin is often thickened and di than normal and some desquamation may be present. This is illustra in Fig. 27, from a man with palmar papillomata. Eleven months la there were no active yaws lesions but the lesions of the soles and he were practically unchanged. Jelliffe & Humphreys (1952) describe simi lesions.

Sometimes it is difficult to be certain if fissures or folds are the p dominant change. This is seen in Fig. 28. Furnell (1943) describes simi lesions. This suggests that these lesions may be the same in origin a that the differences seen may be due to the seasonal differences of wetn and dryness.

In some arid countries extensive fissuring, almost to tessellation b with little desquamation of the soles, may be frequent. Three degre of this are seen in Fig. 29 to 31. These lesions are most marked whe the sole is in contact with the ground. Murray et al. (1956) in their Fig. illustrate the soles of a small boy in Bechuanaland who had mucous patch in the mouth and anal condylomata of endemic syphilis. Marked tessell tion was present on the soles which was probably not treponemal in origi *Hudson (1936) in his Fig. 1* describes identical lesions as extren hyperkeratosis in endemic syphilis in Syria.

Fissures of all surfaces of the heel often commence as superficial arbo escent fissures which may later become deeper (Fig. 32 and 33). In Fig. : (same foot as Fig. 27 and 33) and Fig. 35 (same foot as Fig. 25) the relati freedom from changes of the under part of the heel is seen.

These lesions start in childhood, when there is little or no epiderm thickening, and do not cause much discomfort except in the wet seasor when presumably the swelling of the thickened epidermis of advance lesions may extend the fissures into the dermis. The plantar skin of th

heel may appear as if the thickened epidermis has been worn down walking ("onion skin" effects of Furnell, 1943) These lesions oft accompany the folding and fissuring of the soles referred to under t preceding heading.

Vertical linear fissures of the heel may occur on the lateral, posteri and, to a lesser extent, the medial surfaces Some desquamation may present (Fig 36). The more advanced lesion (Fig 37) consists of dee linear crevices, and the medial part of the skin of the instep may be involve These lesions of the lateral part of the heel in the patient illustrated h undergone considerable spontaneous healing during the previous t months, while those on the medial surface had become more extensi The lesions occur on the margins of the heels, above that part of the sl which comes into pressure contact with the ground. They occur inc pendently of the fissures of the sole. Jelliffe & Humphreys (1952) a describe these lesions.

The illustrations (Fig. 25-37) referred to in the preceding paragrap were all taken during the dry season.

These fissures and folds may occur in patients with early or late acti yaws lesions, in those with no yaws lesions, or in persons whose sera a non-reactive to the reagin serological tests for syphilis, further stud are needed into what causes them

It should be stressed that the soles of healthy persons who walk ba footed on dry, soft, sandy soil are thin, smooth and supple. While cu and scratches may be inflicted on soles by rough, rocky surfaces or cor one would not expect to see any signs of wear on healthy soles unl they were subjected to unaccustomed use.

Fissures of the palms

Fissures of the palms not due to yaws are occasionally seen but a so unlike any palmar lesion due to yaws that confusion should be eas avoided.

Palmar and Plantar Lesions of Known Cause

Corns and callosities are local thickenings of the horny layers of t skin where it is subjected to pressure and friction. Corns are relativ small and penetrate deeply, callosities are diffuse and are frequently se on pressure areas of the soles and on the palms (caused by work) (Fig 1 Corns occur in persons wearing shoes or sandals and are most frequent the knuckles of the fourth and fifth toes. Callosities occur on the sol whether shoes are worn or not. Both are uncommon in children. T surface of callosities is flat, hard and often polished, and of a light yellow

colour (see Fig. 41). They do not closely resemble any yaws lesion, but their tenderness may lead to confusion with early plantar papillomata. Papillomata are *more tender and less hard than callosities. In* some yaws campaigns auxiliary workers spend much time palpating the soles, apparently in the erroneous belief that plantar tenderness is synonymous with plantar yaws.

Plantar warts (*verrucae plantares*) may be single or multiple, and *occur most frequently on* pressure *points (Fig. 38).* They may be confused with plantar papillomata (*Yaws nomenclature,* Fig. 13 B). They are essentially a localized hypertrophy of the epithelium and are in fact infective benign tumours. On other parts of the body they project above the surface, but on the weight-bearing areas of the sole this projection cannot occur and the wart is forced below the surface, where it continues to grow up to 1 cm in diameter and to a depth of 0.5 cm. below the normal skin level. A callous ring and covering invariably form and contribute to the pain and tenderness. At this stage it closely resembles a plantar callosity. Frequently the central point of the callus crumbles away, giving the appearance seen in Fig. 39 and 40. On the heels in these two illustra*tions are mosaic warts caused by coalescence of many warts. The annular* depressions surrounding the warts in Fig. 38 and 39 do not occur round corns.

Adjacent to established plantar warts, tiny pits are frequently observed (Fig. 39-41). When the horny layer is pared away from these pits, tiny warts can be seen in their depths; strong magnification and a good light are necessary. Fig. 41 shows, on the right sole, plantar warts proximal to the right little toe and on the heel with several tiny pits; with these warts is much callosity. On the heel shown in Fig. 40 is probably a large mosaic wart with the same pits adjacent to it.

Warts are due to a virus infection and their high prevalence at times in *villages where there are a limited number of washing places may suggest* an epidemic.

Rat bites *often* occur at *night,* when the thick plantar epidermis may be nibbled by rats without the victim being awakened. This is more likely to *occur when hyperkeratosis is present and where fissures provide an entry for the rats' incisors. The smooth grooves made by the upper incisors* are characteristic, so that the origin of the lesions should be recognized at once (Fig. 42). Furnell (1943) describes these lesions.

Other lesions of the palms and soles that might be confused with yaws hyperkeratoses include the cuts and abrasions in various stages of healing, with or without *secondary infection etc. Such changes are more extensive on the* left hand (Fig. 43), if acquired during bush clearing. These should not cause serious difficulties.

LESIONS LIKELY TO BE CONFUSED WITH LATE YAWS LESIONS

Tropical (phagedenic) ulcers arise from a rapid necrosis and sloughing of the whole thickness of the skin and subcutaneous tissues. They often commence as a vesicle, which is soon followed by inflammation and necrosis (Fig. 44). At this stage there is the characteristically disagreeable and penetrating odour and often a blood-stained discharge, which are never met in yaws. After the slough has been shed (Fig 45 and 46), the underlying muscle, tendon or bone may be exposed, but later this base is covered with granulation tissue (cf. *Yaws nomenclature*, Fig. 25 A and 26 A).

In the early stages of tropical ulcer the base is more depressed and the edge more thickened than in late yaws ulcers Tropical ulcers are painful and occur most frequently on the lower third of the leg Yaws ulcers commence by a slower breaking down and ulceration of necrotic foci and are more frequent than tropical ulcers on the upper limbs and other parts of the body. When a tropical ulcer has reached the granulation stage differentiation from the later stages of a yaws ulcer may be difficult. It is frequently single, as is the late yaws ulcer, and in both conditions the response to penicillin is favourable. Yaws lesions are, however, less deeply destructive, and are often little more than " skin deep " Although superficial late yaws lesions may extend over considerable areas they do not extend deeply to expose muscles and bones, and their development is slower and more gradual than that of tropical ulcers, though in both spontaneous healing is slow.

Granuloma venereum may occasionally be clinically indistinguishable from extensive superficial late yaws ulceration in the genito-crural region The diagnosis can be established by the demonstration of Donovan bodies in scrapings from the lesion.

Cutaneous tuberculosis (Fig 47) and other granulomatous conditions may resemble late yaws ulcers but are unusual at present in areas where yaws occurs Lupus vulgaris (Fig. 48) is infrequent in most tropical countries but may resemble ulcerated nodular late yaws (*Yaws nomenclature*, Fig 26 B)

Perforating ulcers of the sole (Fig 49) mostly follow neural damage from leprosy and usually other indications of this disease are apparent (see page 12). These ulcers occur on the sole on points of pressure and are usually single.

Cutaneous leishmaniasis involving the mucous membranes may resemble gangosa but is unusual except in South America Slow progressive ulceration of the nose and mouth occurs, leading to destruction of the palate and much of the nose, naso-pharynx and lower pharynx.

FIG 1 IMPETIGO CONTAGIOSA

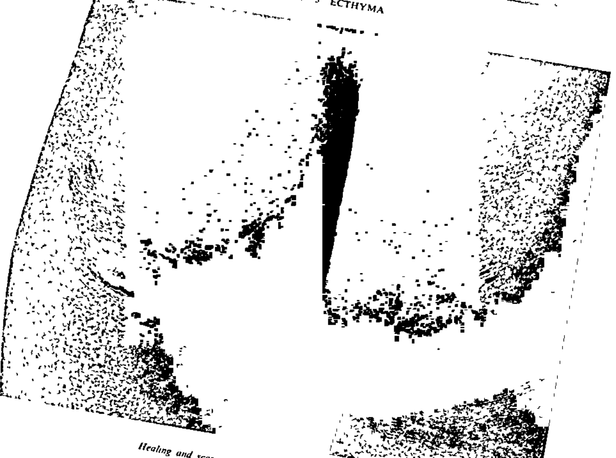


Johannesburg By courtesy of Dr M Ross

FIG. 2 ECTHYMA



Right side of body at about the level of the umbilicus Côte d'Ivoire



Healing and scar

FIG 4 SCABIES



No burrows can be seen but the result of secondary infection, which is nearly always prese is apparent Uganda.

FIG 5 SCABIES



By courtesy of Dr G H V Clarke

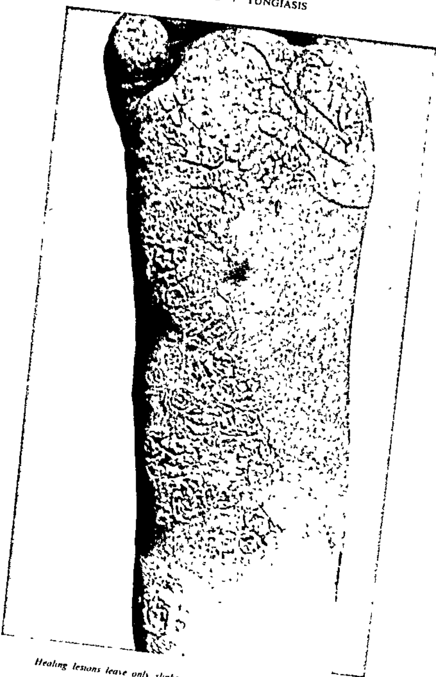
No burrows can be seen but the situation of the infected lesions is characteristic Lagos

FIG. 6 TUNGIASIS



The individual lesions are clearly visible. Uganda

FIG 7 TUNGIASIS



Healing lesions leave only slight scarring Right sole Uganda



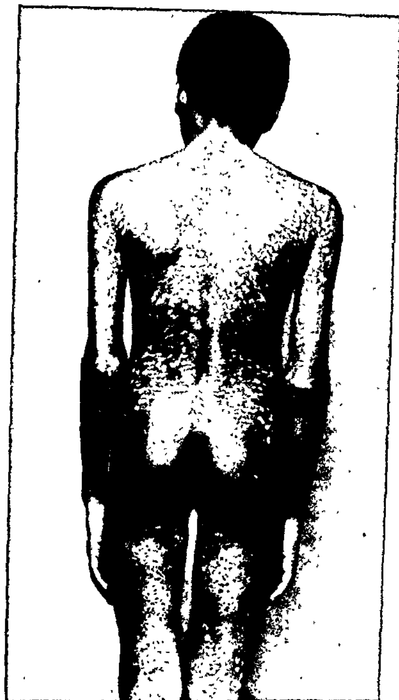
Indeterminate hypochromic macular lesions Côte d'Ivoire.

FIG 9 LEPR

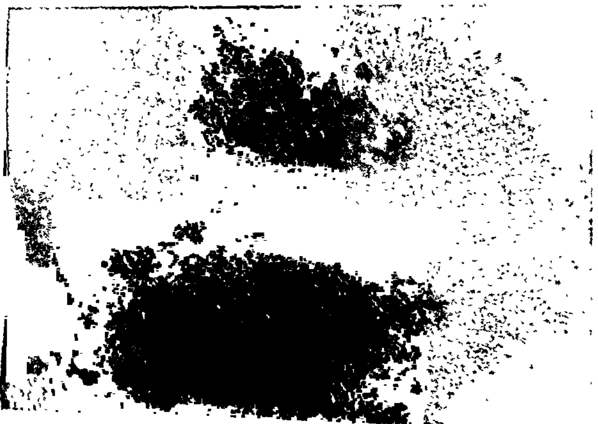


Minor tuberculoid lesions Right side of thorax Uganda

FIG 10 PITYRIASIS ROSEA



By courtesy of the late Dr Howard Fox New York



[illegible] Johannesburg

FIG 14 MYCOSIS OF THE HEEL

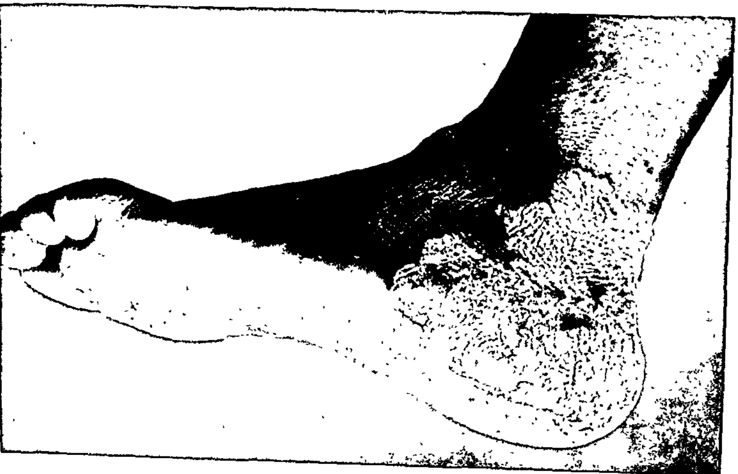


FIG 15 PHRYNODERMA



Outer surface of left knee Johannesburg

FIG 16 SICKLE-CELL ANAEMIA DACTYLITIS



Uganda By courtesy of Dr D B Je

FIG 17 TUBERCULOUS DACTYLITIS



By courtesy of Dr J and Dr C Lambotte-Legrand

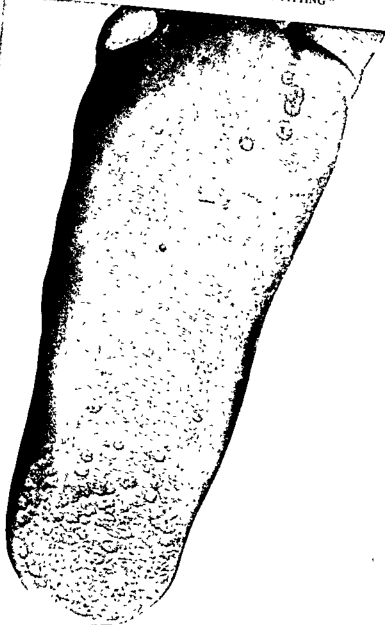
Swelling of the second and third fingers in early tuberculosis in a child aged 5½ years
Belgian Congo

FIG 18 "TROPICAL PLANTAR PITTING"



Keratoma plantare sulcatum of Castellani (1910) Small deep pits with some variation in size Early lesions on anterior part of sole Northern Haute Volta

FIG 19 "TROPICAL PLANTAR PITTING"



Larger, flatter pits more uniform in size than in Fig 18 Northern Haute Volta

FIG 20 "TROPICAL PLANTAR PITTING"



Linear coalescence Côte d'Ivoire

FIG 21 "TROPICAL PLANTAR PITTING"



Lesions on anterior part of sole Central Java

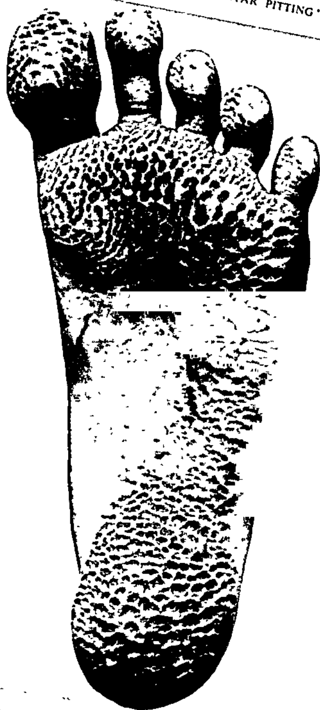
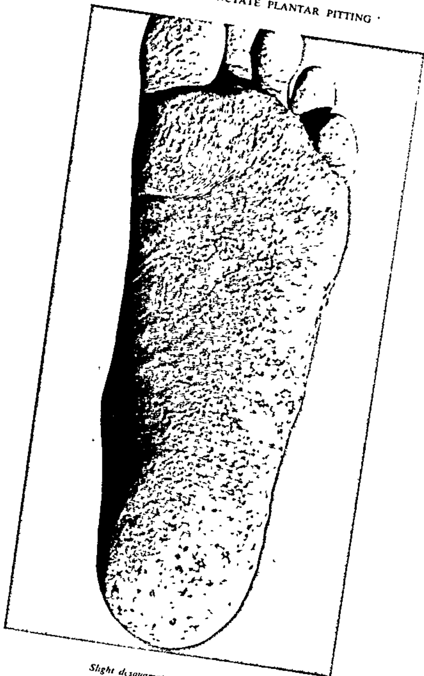


FIG 22 "TROPICAL PLANTAR PITTING"

...rked lesions Note relative freedom of undersurface of toes Central Java

FIG 23 · PUNCTATE PLANTAR PITTING ·



Slight desquamation Mauritania

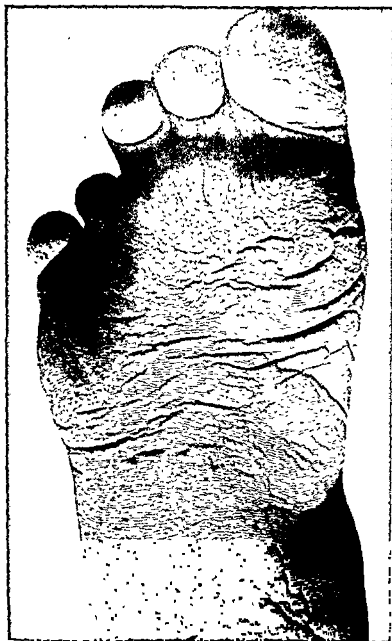
FIG 24 KERATOMA DISSIPATUM HEREDITARIUM PALMARE
(BRAUER, 1912)



By courtesy of Dr N M van der Hoff

Keratodermia punctata of Chalmers & Kamar (1917) Characteristic palmar changes Many plugs present British Cameroons

FIG 25 PLANTAR FOLDING ALONG SKIN CREASES



Very few fissures Same foot as in Fig 35 Uganda

FIG 26. PLANTAR FISSURES



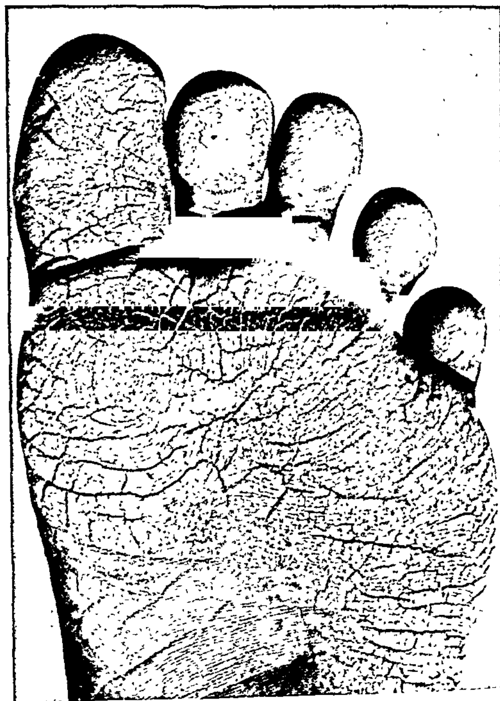
Uganda

FIG 27 PLANTAR FISSURES WITH DRYNESS AND DESQUAMATION



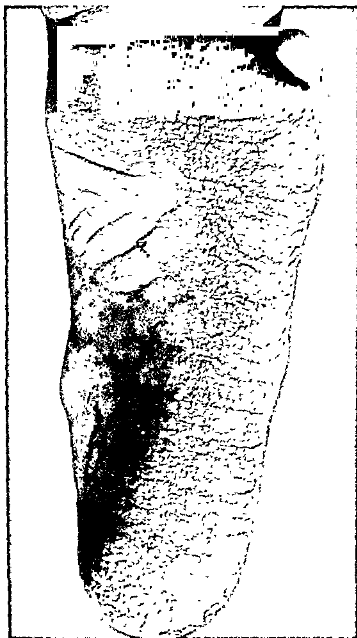
Same foot as in Fig 33 and 34 Uganda

FIG 28 PLANTAR FOLDING AND FISSURES



Uganda

FIG 29 EXTENSIVE SUPERFICIAL PLANTAR FISSURES WITH SLIGHT DESQUAMATION



Mauritania

FIG 30 EXTENSIVE SUPERFICIAL PLANTAR FISSURES



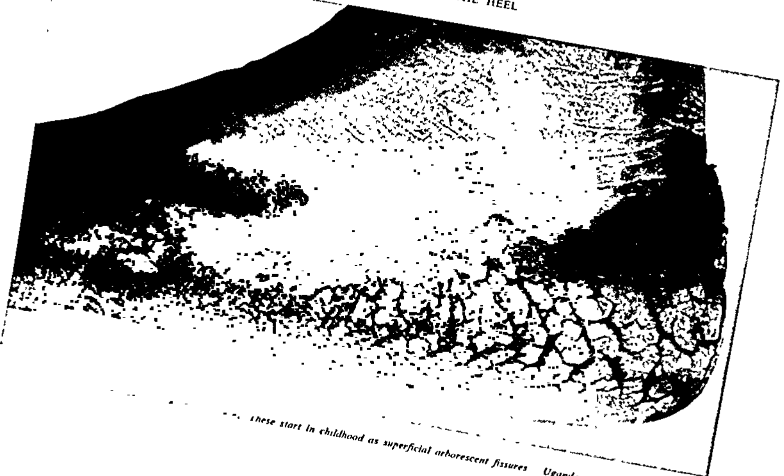
Mauritania

FIG 31 EXTENSIVE SUPERFICIAL PLANTAR FISSURES



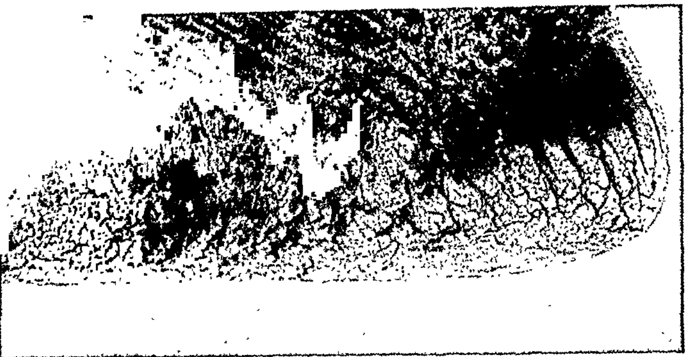
Marked changes Muuniamo

FIG 32 FISSURES OF THE HEEL



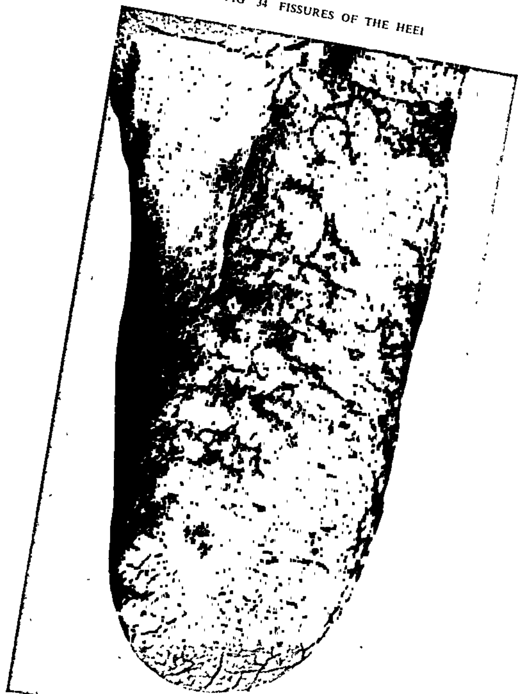
... these start in childhood as superficial arborescent fissures   Uganda

FIG 33 FISSURES OF THE HEEL



Outer surface of left ankle Same foot as in Fig 27 and 34 Uganda

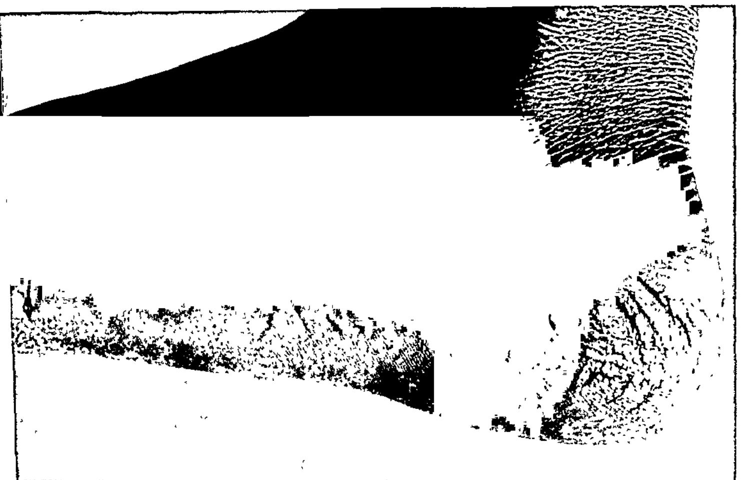
FIG 34 FISSURES OF THE HEEL



Left sole Under surface of heel shown in Fig 33 Uganda.



FIG 36 VERTICAL LINEAR FISSURES OF THE HEEL

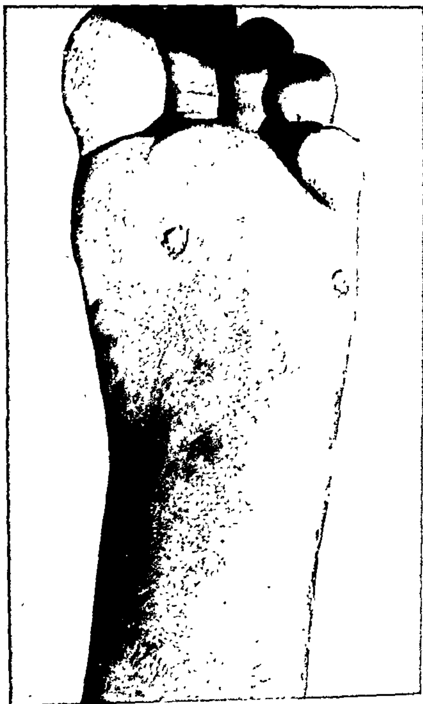


Plantar surfaces have remained normal Outer margin of left foot Uganda

FIG. 17 VERTICAL LINEAR FISSURES OF THE HEEL AND FISSURES IN INSTEP

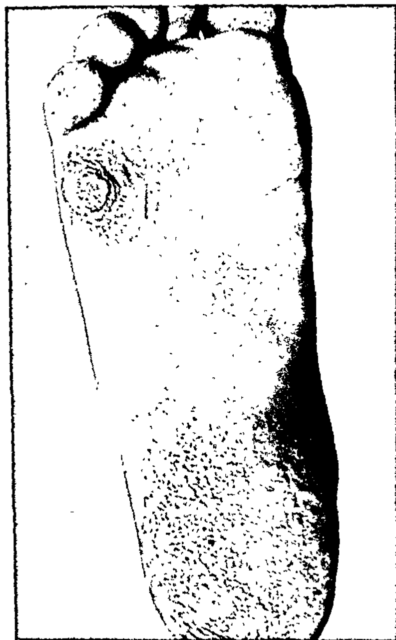


FIG 38 SMALL PLANTAR WARTS OVER HEADS OF METATARSALS



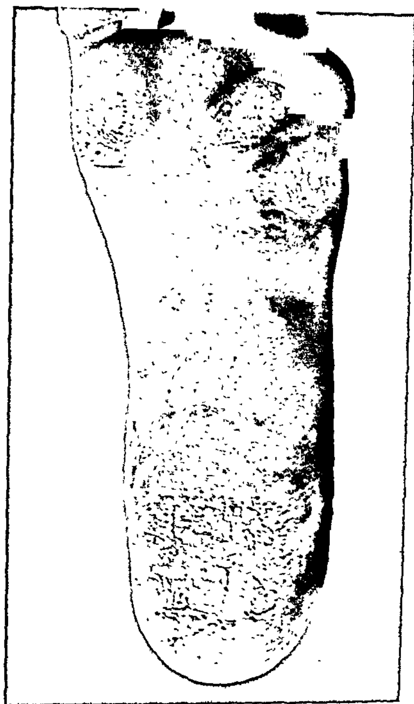
Côte d'Ivoire.

FIG 39. PLANTAR WART OVER HEAD OF FIFTH METATARSAL AND MOSAIC WART ON HEEL



Note small pits near these lesions Côte d'Ivoire

FIG 40 PLANTAR WARTS AND MOSAIC WART ON HEEL



Note small pits and some degeneration and desquamation of thickened epithelium Côte d'Ivoire.

FIG 41 PLANTAR WARTS WITH WELL-DEVELOPED CALLOSITIES



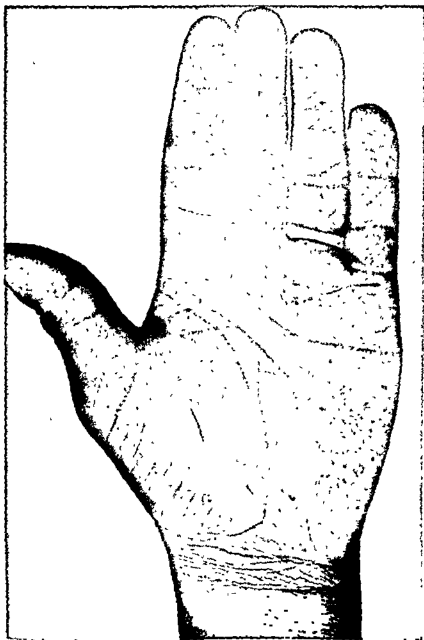
Note small pits on right sole The straight sides of the lesions suggest some previous treatment
Johannesburg

FIG 42 RAT BITES



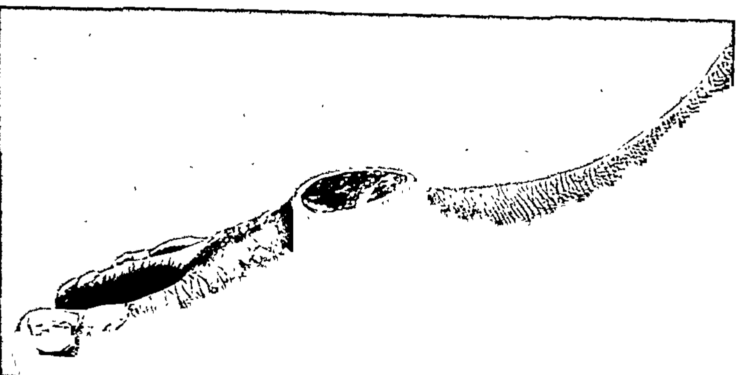
Uganda

FIG 43 MULTIPLE INJURIES TO LEFT HAND FROM HOLDING VEGETATION TO BE CUT WITH IMPLEMENT HELD IN RIGHT HAND



Liberia

FIG 44 TROPICAL ULCER



The slough has recently separated. This ulcer commenced as a vesicle on an oedematous area, which was attributed by the patient to a slight burn. a few days later the slough appeared. Uganda.

FIG 45 TROPICAL ULCER



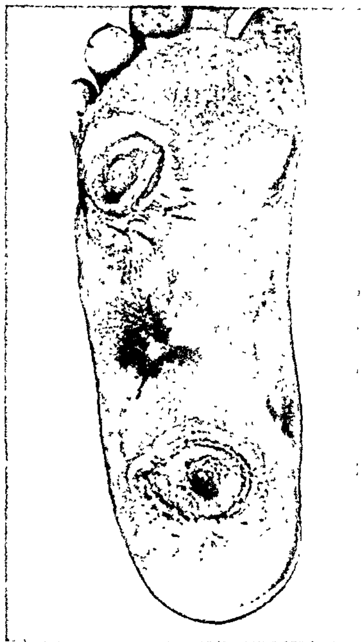
The base is coarse granulation tissue but the edge is still raised A blood stained discharge is frequent Anterior surface of left leg Liberia

FIG 48 LUPUS VULGARIS



By courtesy of the late Dr Howard Fox, New York

FIG. 49. PERFORATING ULCERS IN LEPROSY



By courtesy of Dr V. Martinez Dominguez

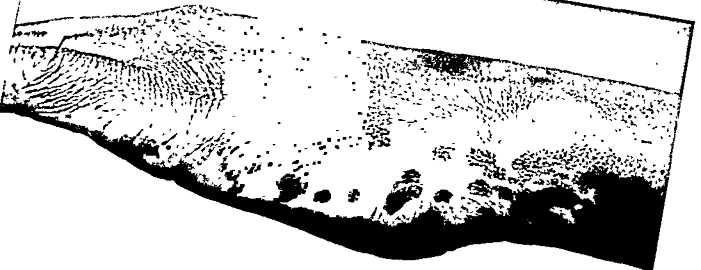
Spanish Guinea

FIG 50 BLASTOMYCOSIS



Muco-cutaneous lesion Brazil

31 DEPIGMENTATION WITH NO APPARENT SCARRING



Uganda

FIG 52 DEPIGMENTATION OF LEFT WRIST WITH NO APPARENT SCAR



Uganda.

Annex

A SUMMARY OF SOME REFERENCES TO TWO TYPES OF PLANTAR LESIONS

"Tropical plantar pitting" and "keratoma dissipatum hereditarium palmare et plantare" (Brauer, 1912, Kiess, 1930) have been referred to frequently in the literature of tropical medicine, the former as "keratoma plantare sulcatum" originally by Castellani in 1910 and the latter as "keratodermia punctata" originally by Chalmers & Kamar in 1917. Considerable confusion has arisen about the cause of these conditions.

Keratoma Plantare Sulcatum (Castellani, 1910)

(see page 16)

Castellani (1910) and Castellani & Chalmers (1910b) say that keratoma plantare sulcatum is prevalent in barefooted Indian and Chinese labourers. The epidermis of the anterior part of the soles and of the heels is thickened and yellowish with numerous deep furrows, which may be straight, semicircular or elliptical, and which appear dark owing to the debris collected in them. If this debris is removed the furrows are pinkish or whitish. There is no local inflammation but the feet may be tender and painful after much walking. The condition is most frequent during the rainy season and improves or disappears during the dry season. Rest and the application of salicylates may produce marked improvement. Fig. 336 in Castellani & Chalmers (1910b) closely resembles Fig. 22 of this monograph.

Baermann (1911) illustrates the sole of a patient with early yaws in which there is plantar hyperkeratosis of yaws and also keratoma plantare sulcatum (his Fig. 72 on Plate 6) which resembles our Fig. 22. In his description he makes no mention of the keratoma.

Castellani & Chalmers (1913, 1919) add to their earlier description (Castellani & Chalmers, 1910b) that the condition occurs in Ceylon, India and tropical Africa and that it consists of deep sulci and punched-out holes in thickened epidermis. Mercury and iodides have no effect.

Castellani (1949) includes keratoma plantare sulcatum among the "little-known tropical diseases". He says that the cause is unknown, that the Wassermann reaction is usually negative and that antisyphilitic treatment has no effect on it. The diagnosis "is based on the presence of the characteristic deep sulci and punched-out holes in the thickened epidermis, which are absent in the lesions of the soles of the feet of syphilitic origin".

He also states that the pitted plantar lesions due to yaws do not have seasonal variation which is a feature of the condition discussed here.

Gutierrez (1922; p. 281) says that keratosis is the most frequent l yaws lesion. He says that it is sometimes called clavus and was cal by Castellani & Chalmers (1919) "peculiar pitted condition of the hands He has no doubt that it is a tertiary lesion which may appear "during t latter phase of the secondary eruptions, as observed by Castellani. (the other hand, it may appear years after all signs of the disease ha disappeared".

Gutierrez (1923) writes of "keratosis palmaris et plantaris" due yaws. His evidence that yaws is the cause is rather uncertain. He sa that there are two types:

(1) Thickened palms or soles (hyperkeratosis) from which sago-gra whorls of hardened corneum fall out. There is tenderness on walkin He calls the condition claviform keratosis. Several months after a fe injections of arsphenamine the lesions appeared to have improved in few cases. His illustrations of plantar lesions (Fig. 1 and 9 of his pape do not very closely resemble keratoma plantare sulcatum and his descri tion is more that of keratodermia punctata (Chalmers & Kamar, 1917 He refers to the description by Castellani & Chalmers (1919).

(2) Thickening of the corneal layers (keratosis) without the formatio of grain-like whorls. It is associated with hyperigmentation, may sprea to the dorsa of the hands and feet, and results in depigmentation.

While the second type might well be due to yaws, the first is probabl not. He appears to regard both lesions as late or tertiary yaws lesion:

Gutierrez (1925), in a paper on the late manifestations of yaws, say that "secondary and tertiary" and even "primary, secondary and tertiary lesions can occur at the same time in the same patient. He says tha Castellani & Chalmers (1919) were the first to use the name "keratom plantare sulcatum" but that it was known under several other names Gutierrez proposed to change the name to "keratoderma palmaris e plantaris [*sic*] sulcatum" in accordance with Chalmers & Kamar (1917 and because the palms were also involved. It is, he says, the most frequen late lesion of yaws. He refers to his previous paper (1923), in which h says there are two types of this lesion. His description is rather confusin for it appears that he includes, under the name he proposes, all non papillomatous yaws lesions of the hands and feet, as well as keratoma plantare sulcatum and keratodermia punctata (Chalmers & Kamar, 1917). His Fig. 8, which has the caption "Keratoderma plantare sulcatum showing pits of cornlike bodies", resembles neither Fig. 22 nor Fig. 24 of this monograph. He says that the lesions to which he refers may appear directly after the secondary manifestations have healed or twenty years after they

have disappeared and all manifestations of the disease have gone. When once they have appeared they last for life. As the lesion progresses it may involve the dorsa of the hands and feet and even the skin of the knees and elbows

Bittner (1926) says that keratoma plantare sulcatum is known in India, Africa, Java and Sumatra The cause is unknown but he thinks that it is a late yaws lesion. There are "deep sulci with punched-out areas in tremendously thickened epidermis of the plantar surface" and also great pain and tenderness on walking Hands as well as feet may be affected. It may appear after yaws papules have disappeared, and therefore, if it is due to yaws, it is a late lesion. A single injection of neoarsphenamine completely healed the painful plantar fissures in three cases whose sera were reactive to the Wassermann test. He does not, however, record the effect on the "punched-out areas". His Fig 3 is of yaws hyperkeratosis over the heads of the metatarsals and the heel with the lesions of keratoma in thickened epidermis along the lateral part of the foot between these areas These changes resemble those in Fig 22 of this monograph The lesions of the hands are not distinct in the illustration, but may possibly be those of keratodermia punctata (Chalmers & Kamar, 1917)

Acton & McGuire (1930) say keratolysis plantare sulcatum is the same as Castellani's "peculiar pitting of the hands and feet" and keratoma plantare sulcatum. They refer to Chalmers & Kamar (1917), Castellani (1920) and Gutierrez (1923, 1925).

Acton & McGuire say keratoma plantare sulcatum and keratodermia cribrata (see below) "have been very much confused by many workers with late manifestations of yaws" and that keratoma plantare sulcatum is actinomycotic while keratodermia cribrata is a late syphilitic manifestation, in fact, the latter is pathognomonic of syphilis Keratolysis plantare sulcatum is prevalent in Bengal during the monsoon in barefooted people They have seen it in two Europeans. Yaws did not occur in Bengal It starts as pits with irregular edges which coalesce, like a moderately coarse sponge, to form furrows. Their Plate I, Fig. I resembles Fig 21 and 22 of this monograph.

Acton & McGuire (1931) deal with lesions of the skin of the hands and feet due to *Actinomyces keratolytica*. They say that this organism—which they describe as a new species—is responsible for split and cracked heels with hyperkeratosis, keratolysis plantare sulcatum, mango toes (interdigital sodden epithelium), paronychia, onychomycosis and vesicular eruptions The condition has occurred in European ships' officers. They claim to have isolated the fungus from 42 consecutive patients and to have reproduced lesions in human volunteers. The application of formalin, glycerine and gentian violet will cure the infection.

It is most frequent on the heel and treads of the foot. The palms are rarely attacked There is no localized hyperkeratosis nor inflammation

of the sole. In keratodermia cribrata there is hyperkeratosis and horny plugs can be lifted out. They isolated *Actinomyces bovis* from the lesions and say that the pits or furrows are due to lysis of the horny cells.

Keratolysis plantare sulcatum can be prevented and cured by the application of 5% formalin and keeping the feet dry.

Hermans (1931) refers to a condition seen in the Moluccas in which there are cracks or deep clefts which may be very painful. His Fig. 14 illustrates the condition, which he says responds to arsenic. It resembles Fig 37 of this monograph but with more erosion, which is suggestive of a yaws lesion. He continues that Castellani describes the same condition as keratoma plantare sulcatum, and his Fig. 15 is of this condition and resembles Fig. 20 of this monograph. He appears to be referring to two different lesions.

Hermans (1939) says that Castellani gave the name " keratoma plantare sulcatum " to plantar lesions of yaws characterized by hypertrophy of the margins of the feet in which painful fissures developed. This description does not appear to refer to keratoma plantare sulcatum.

Aars (1931) describes keratoma plantare sulcatum. It is a thickening of that part of the soles in contact with the ground. The horny layer of the epidermis contains numerous holes of different sizes and depth and later many fissures, which never extend more deeply than the inner limits of the stratum corneum. The lesion is worse in the rainy season; pitting and fissuring disappear in the dry season but the thickening remains. The thickening is at first spongy but later becomes hard and horny.

Aars never saw plugs in the lesions, nor did he see the palms affected. The lesions were never wet, and he saw them only in men. His illustration closely resembles Fig. 21 of this monograph. He says the condition is not very painful.

He summarizes the histopathological changes as follows:

> " The corium showed small perivascular infiltrations extending to the papillary layer and consisting mainly of lymphocytes. Moderate acanthosis and a slight degree of *spongiosis* were noted in the rete malpighii. In one case considerable oedema was [illegible] giving rise [illegible] thickened [illegible] ding with [illegible]

Aars (1934) says keratoma plantare sulcatum occurred in Africans in Dutch Guiana (Surinam), in Javanese and in Indians, particularly in the rainy season. There is thickening of the epidermis, where the sole touches the ground, in which the depressions develop. The lesion never extends more deeply than the inner parts of the stratum corneum. The depressions are darkened by debris. The condition appears early in life but only after the individual has started to walk. In the wet season the epidermis is spongy and in the dry season it becomes a dry hyperkeratosis. *Symptoms*

are not marked; only in the wet season may pain or "burning" of the feet be experienced after much walking.

He refers to the writings of Castellani, Hermans, Baermann and Acton & McGuire. Aars does not think the condition is due to a fungus nor to yaws. He says Castellani called attention to seasonal variations, absence of palmar lesions, seronegative reactions, absence of response to antisyphilitic treatment, commencement in early childhood and lack of previous history of yaws. His illustration closely resembles Fig. 22 of this monograph. He thinks the name for the condition should be "keratodermia [sic] plantare sulcatum (Castellani)".

Furnell (1943) reported observations mainly on Gold Coast (Ghanaian) soldiers, half from coastal areas and half from the northern territories. He described two main lesions

(1) Cracked soles with or without hyperkeratoses and cracking of the heels. This is relatively painless and occurs in dry areas, he thought it was due to excessive drying and injury from fine particles of sand His Fig. 1 closely resembles Fig. 28 of this monograph, with more marked folding.

(2) Pitting of thick skin of the sole which, he says, is identical with Castellani's keratoma plantare sulcatum. It may be present at the same time as cracks of the soles He thinks that injury and wetness are important causes of these lesions. He claims that these lesions developed in a European after spending four hours a day in a mangrove swamp for one week wearing only light canvas shoes He says it is not seen in habitual sandal wearers His Fig. 2 shows lesions closely resembling those in Fig 22 of this monograph.

Other lesions he saw were corns (clavus) and plantar warts (verrucae plantares), rat bites and "cut-onion effects" on the heels which, he thinks, were due to wear during military foot-drill. None of the lesions he describes were seen in Africans who habitually wore sandals.

The reactions of the Kahn tests were no different in soldiers with these plantar lesions and in others with none The response to arsenical preparations was "very disappointing", but the wearing of sandals hastened healing.

Jelliffe & Humphreys (1952), in a survey of 464 Nigerian soldiers stationed at Ibadan, Western Nigeria, found marked plantar lesions in 31 individuals The lesions were as follows

(1) Deep transverse and longitudinal fissures of the sole (17 cases) There were also superficial fissures resembling Fig 27 of this monograph, but in their Fig. 1 "moderate scattered pitting" was also apparent

(2) Plantar pitting, small (pin-point to a few millimetres), on the plantar surface, except for areas that did not have contact with the ground

(13 cases). These were sometimes limited to the heels. When they were extensive a "lace pattern" resulted. Their Fig. 2 resembles but is not identical with keratoma plantare sulcatum (Fig. 21 of this monograph) as the pits are smaller and relatively deeper. They say, however, that the pitting that they saw and keratoma plantare sulcatum "seem to be similar".

(3) Fissuring of the rim of the heel in markedly thickened hyperkeratotic skin with multiple deep, usually painless fissures on the postero-lateral aspects of the heel; frequently bilateral (10 cases).

(4) Erosions of the plantar skin, which were superficial and multiple, and of varying sizes and irregular shape (6 cases).

(5) Postero-lateral thickening of the heels (4 cases).

Moderate, mostly painless, plantar changes were found in 196 soldiers (31%). The most frequent findings in these were lesions of type 5 above (100 cases) and superficial lesions of type 1 (54) and type 2 (24).

Eleven of the 31 marked cases were seroreactors, but those with the most marked lesions were non-reactive. No serological studies of soldiers without plantar lesions were reported.

Jelliffe & Humphreys think that most of these lesions were not due to yaws. In only two cases was infection with yaws possible; these were seroreactors and responded to treatment with neoarsphenamine. Most of the plantar changes occurred in soldiers from non-yaws areas who *had sedentary duties. They think that the lesions are probably due to* trauma of hot, dry, stony ground.

Tengko Chen (1952) reports the high prevalence of this lesion in Taiwan especially in adolescents and adults who worked bare-footed in moist conditions.

Clarke (1959) illustrates this condition as a plantar hyperkeratosis but says the cause is usually unknown. Turner (1959) also illustrates it among the plantar lesions not due to yaws.

Da Motta (1952), in an article on the palmo-plantar lesions of yaws, appears to include keratodermia plantare punctata (his Fig. 12) among *the punctate keratodermias* which he regards as due to yaws.

Keratodermia Punctata (Chalmers & Kamar, 1917)
Synonym: Keratodermia Cribrata (Castellani & Chalmers, *1919)*

(see page 17)

Castellani & Chalmers (1910a) refer to a "peculiar pitted appearance of the palms".

"In several cases in the latter part of the secondary stage [of yaws] hard, round, flattened papules or small nodules having a thick hard epidermic plug in their centre, may be observed on the palms and wrists. This plug falls off spontaneously or is easily

pulled out, when a depression remains The papules gradually disappear, but the depressions remain, and the palms acquire a peculiar pitted appearance This condition of the palms may remain unchanged for several years after all symptomatic yaws have disappeared A somewhat similar appearance of the soles of the feet is occasionally met with "

Chalmers & Kamar (1917) describe as keratodermia punctata, pitting of the skin of the palmar surface of the hands from the distal skin folds of the wrist to the terminal phalanges—a condition which they observed on the hands of a Sudanese woman barber. The pits are sunk into the epidermis in patches of thickened epidermis There is *no* hyperaemia The lines of skin flexures may be fissured The following is their description:

"When examined carefully by means of a low-power lens it is noticed that the horny layer of the epidermis is heaped up into a little circular ring at the orifice of a sweat duct. This heaped-up mass of horny cells increases in size and joining with other similar small masses, forms a small translucent cupola or irregularly shaped swelling which may exude fluid at its apex and forms a small central umbilicated scab

"This scab becomes surrounded by a circular depression, which gradually deepens, and marks off a deep cone-shaped horny plug not unlike the core of a corn, while the surrounding epidermis becomes erythematous

"The central corn-like mass comes away and leaves behind a deepish cavity possessing a reddish base, steep walls, and undermined horny edges This depression appears to be entirely situate in the horny layer

"It is the formation of these depressions which gives rise to the pitted appearance of the hands, while the cores before separation look like small corns

"The depression so produced gradually fills up from the bottom with horny cells but in so doing is apt to give rise to crusts which, when removed, show that the cavity is becoming shallower, while its edges become rolled in and not undermined

"When completely filled in it forms a small thickened area which, when joined to similar areas, forms a horny patch

"The sweat pores on such a horny ridge or patch are quite patent, as can be demonstrated by stimulating the horny tissue in the neighbourhood by means of a needle, when the sweat can be seen by means of a lens to exude from the pores, while a marked local erythema is also produced "

They also describe in detail the pathological changes seen in biopsy material, the possible causes of the condition, its differential diagnosis and its nomenclature. The paper is well illustrated.

They summarize ·

"The characteristic features of Keratodermia punctata are the formation of corn-like hyperkeratotic punctations, preceded by small translucent, cupola-shaped swellings which may exude fluid, and which are formed in association with the orifices of the sweat ducts

"The corn-like punctations become loosened and fall out, leaving pits or depressions which fill up and form horny patches on which the sweat pores are patent "

Having excluded syphilis and yaws as possible causes they conclude that the condition is of unknown origin and "worthy of consideration as a separate skin affection". They say that keratodermia punctata may

affect palms and soles and that it is not the same as keratoma plantare sulcatum (Castellani), which is restricted to the soles and which, in addition to depressions in the skin, has furrows.

It was almost certainly referred to by Castellani & Chalmers (1910a), since it is illustrated by them later (Castellani & Chalmers, 1919). Castellani & Chalmers (1919) illustrate punctate lesions in their Fig. 696 but these are not named, described or cross-referenced (p. 2257).

Castellani & Chalmers (1919) describe as keratodermia cribrata a localized non-follicular hyperkeratosis of the hands and feet in which the changes are "little pits caused by the shedding of little corn-like projections". It is said that "in some remote way the condition is associated with framboesia or syphilis, congenital or acquired, and changes in the metabolism but not by the action of parasites". There is a mild chronic inflammation of the dermis and a hyperkeratosis of the sweat orifices leading to the formation of corn-like projections which are freed peripherally and finally completely, and then fall out, leaving depressions. Palms and soles are affected, causing slight itching. The condition is bilateral and very chronic; its cause is unknown; and no treatment benefits it. Their Fig. 884 illustrates the condition.

Castellani (1922) states that keratodermia cribrata must be regarded as a quaternary yaws lesion, often seen with secondary lesions and also with no such signs, and may occur in people with no history of yaws.

Castellani (1923) gives keratodermia punctata as a synonym of keratodermia cribrata; the description is identical with that of Castellani & Chalmers (1919).

Acton & McGuire (1930) regard keratodermia cribrata of Castellani and keratodermia punctata as synonymous. Localized hyperkeratosis is present and in India these conditions are always due to syphilis. Their Plate 2, Fig. 3 resembles Fig. 24 of this monograph.

Hermans (1931) describes a condition in which "the thickened horny layer has a very characteristic aspect by reason of the numerous smaller and larger holes formed by the falling out of little balls of horny thickening". He refers to the description of Castellani & Chalmers (1910a) of the same lesion and says that Gutierrez (1923) gave the name keratoderma punctatum [sic] to it. Although the paper by Chalmers & Kamar (1917) is listed in his "Literature", he does not refer to it in relation to this lesion. He says that Spitt believed it to be due to yaws and that Powell saw it in Assam but did not think that it was due to yaws. Hermans often saw it in the Moluccas, and thought that it was most probably due to yaws.

Hermans (1939) again refers to this condition in which small particles, from the size of a pin's head to 5 mm in diameter, of the corneal layer become detached. The margins are more or less raised. These lesions may become confluent and extend to cover a large part of the palm or sole.

The latter part of the description and his Fig. 4 do not resemble keratodermia punctata (Chalmers & Kamar, 1917).

Da Motta (1952) says that one of the yaws lesions of the palms and soles is a punctate keratodermia and that it is very similar to the keratodermia disseminata plantaris et palmaris of Buschke & Fischer or porokeratosis papillomatosa. The first of these, the keratodermia of Buschke & Fischer, is synonymous with the keratoma of Brauer (1912) and is not due to yaws.

Keratodermia punctata appears to be synonymous with Buschke-Fischer or Brauer disease. It is ubiquitous and has no relationship to yaws or other treponematoses.

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